ADOT ECS File: JPA 98-55
Project No. SPR-481
TRACS No.: R0481 10P
Research: RHODES-ITMS Ramp
Metering Field Testing

INTERAGENCY AGREEMENT
BETWEEN
THE DEPARTMENT OF TRANSPORTATION
AND
ARIZONA BOARD OF REGENTS THE UNIVERSITY OF ARIZONA

THIS AGREEMENT is entered into 9-10-98, 1998, between agencies of the State of Arizona, to wit, the DEPARTMENT OF TRANSPORTATION (the "DOT") and the ARIZONA BOARD OF REGENTS, acting for and on behalf of UNIVERSITY OF ARIZONA, (the "University").

I. RECITALS

1. The DOT is empowered by Arizona Revised Statutes Section 28-401 to enter into this agreement and has by resolution, a copy of which is attached hereto and made a part hereof, resolved to enter into this agreement and has delegated to the undersigned the authority to execute this agreement on behalf of the DOT.

2. The University is empowered by Arizona Revised Statutes Section 15-1626 to enter into this agreement and has delegated to the undersigned authority to execute this agreement on behalf of the University.

3. The DOT and the University desire to conduct field testing and achieve the development and implementation of freeway ramp metering systems, at an estimated cost of $100,000.00, all at DOT expense, hereinafter referred to as the Project.

THEREFORE, in consideration of the mutual agreements expressed herein, it is agreed as follows:

II. SCOPE OF WORK

1. The DOT will:

a. Appoint a Project coordinator within the DOT's Transportation Technology Group to interface with the University relating to the research and development.

b. Provide the University with information and data as may be reasonably available to assist in the Project research and development.

c. Reimburse the University within forty-five (45) days after receipt and approval of monthly invoices, in a total amount not to exceed $100,000.00.

2. The University will:

a. Appoint a Project coordinator at the University (U of A) to interface with the DOT relating to the research and development.

b. Accomplish the field testing and development generally in accordance with Exhibit A, which is attached hereto and made a part hereof, including the validation of previous laboratory research and project development of the ramp metering control algorithms, and a final report documenting the program, data derived, and the final results. Such reports will be in a format compliant with the DOTs "Guidelines for Preparing Research Reports."

c. No more often than monthly, invoice the DOT in the form of Exhibit B attached hereto, supported by narrative reports and an accounting of monthly costs and expenditures on the Project. Upon completion of the Project, provide the DOT with a detailed final report.

III. MISCELLANEOUS PROVISIONS

1. Title to all documents, reports and other deliverables prepared by the University in performance of this agreement shall rest jointly with the DOT and the University.

2. This agreement shall become effective upon signature by the parties hereto, and shall remain in force and effect until completion of said Project and reimbursements; provided, however, that this agreement, may be cancelled at any time prior to the commencement of performance under this agreement, upon thirty (30) days written notice to the other party.

3. The parties agree to comply with all applicable state and federal laws, rules, regulations and executive orders governing equal employment opportunity, immigration, nondiscrimination and affirmative action.

4. This agreement may be cancelled in accordance with Arizona Revised Statutes Section 38-511.

5. The provisions of Arizona Revised Statutes Section 35-214 are applicable to this contract.

6. In the event of any controversy which may arise out of this agreement, the parties hereto agree to abide by required arbitration as is set forth for public works contracts in Arizona Revised Statutes Section 12-1518.

7. All notices or demands upon any party to this agreement relating to the agreement shall be in writing and shall be delivered in person or sent by mail addressed as follows:

Department of Transportation Joint Project Administration 205 S. 17th Avenue - 616E Phoenix, AZ 85007	University of Arizona Research & Contract Analysis 2030 E. Speedway Room 222 Tucson, AZ 85719

8. The parties recognize that performance by the U of A under this Agreement may be dependent upon the appropriation of funds by the State Legislature of Arizona. Should the Legislature at any time fail to appropriate the necessary funds for such performance, the, by written notice to the DOT, the U of A may cancel this Agreement.

IN WITNESS WHEREOF, the parties have executed this agreement the day and year first above written.

STATE OF ARIZONA

THE ARIZONA BOARD OF REGENTS acting for and on behalf of THE UNIVERSITY OF ARIZONA

By _____
JAMES. T. WHEELER, Director
Office of Research and
Contract Analysis

DEPARTMENT OF TRANSPORTATION

By _____
TIM WOLFE
Ass't State Engineer

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JPA 98-55

RESOLUTION

BE IT RESOLVED on this 8th day of April 1998, that I, the undersigned MARY E. PETERS, as Director of the Arizona Department of Transportation, have determined that it is in the best interests of the State of Arizona that the Department of Transportation, acting by and through the Intermodal Transportation Division, to enter into an agreement with the University of Arizona for the purpose of defining responsibilities for conducting field testing of the RHODES-ITMS ramp metering systems.

Therefore, authorization is hereby granted to draft said agreement which, upon completion, shall be submitted to the Ass't State Engineer for approval and execution.

DAVID ALLOCCO, Manager
Engineering Technical Group
for Mary E. Peters, Director

Intelligent Transportation Systems (ITS)

Project 481, FY '99
Field Test of RHODES-ITMS Ramp Metering Systems

Research Agency:	University of Arizona	Program Date:	07/01/98
Principal Investigator(s):	Dr. Pitu Mirchandani	Contract Date:	Pending
Contract Amount:	$100,000	Original Completion Date:	06/30/99
Program Budget:	$100,000	Estimated Completion Date:	TBD
Expenditures to date:	$0	Is project on schedule?	N/A
Percent complete		TRACS No.:	R048111P
through 6/30/98:	0%	Responsible ATRC Staff:	Steve Owen

PROBLEM STATEMENT

The ongoing RHODES-ITMS projects have produced a freeway corridor control scheme using real-time ramp metering strategies. The ramp metering rates are set with primary consideration of freeway objectives, such as smooth flow, speed and throughput, and with secondary objectives of managing queues and buffers at the on-ramps. It should be noted that for most metropolitan areas, ramp-metering rates are not proactively adaptive but are fixed by the freeway management system, often with different rates at different time periods.

Preliminary laboratory testing with simulation models of the RHODES corridor control algorithms indicates that the strategies perform much better than the current fixed rate strategies, having smaller ramp queues with equal or less traffic congestion on freeways. The next step in research and development of RHODES-ITMS is to conduct field tests of this latest corridor control logic.

Traffic congestion and travel speeds on a freeway segment within a corridor depend on the through volumes, off-ramp volumes, on-ramp volumes, posted speeds, ramp-metering rates, traffic incidents and travel advisories. The major "controls" are the posted speed limits, travel advisories, and on-ramp metering rates. In this field test, only the latter will be monitored and controlled in real-time.

This project will develop and implement a strategy to set variable ramp-metering rates that allow the FMS to also include consideration of freeway and surface street objectives, including queue delays, in real-time. This concept complements the current interchange control logic, and will more fully meet the service needs of the local jurisdictions as well as the ADOT FMS.

The proposed field tests of the real-time ramp metering algorithms will demonstrate to ADOT and local jurisdictions the benefits of balancing the freeway level of service with the service needs of the urban arterial. The field test will enable the researchers to refine the strategies and algorithms, and to develop solutions that will be suitable for a large-scale deployment.

RESEARCH OBJECTIVES

The objective of this project is to conduct operational tests of the RHODES-ITMS corridor control logic, as developed in recent laboratory research efforts by the University of Arizona. The field test will verify the effectiveness of the RHODES-ITMS adaptive ramp-metering algorithms, establish the cost component for future implementations, and evaluate the effectiveness of the concept.

At a minimum, the research will include the following tasks:

- Meet with the Technical Advisory Committee (TAC) to review the scope and work plan.
- Develop a field test plan which (a) identifies the site location, and (b) specifies requirements for any additional communications / software / hardware.
- Develop an evaluation plan for measures of effectiveness, data needs, and methodology.
- Implement necessary new communications / software / hardware (with subcontractor). Design plan sheets documenting any field system changes are to be approved by a registered engineer.
- Conduct full-scale bench testing in simulated conditions of these components and systems.
- Develop algorithms and software for the Phoenix Traffic Operations Center.
- Validate system functionality and evaluation approach off-line, prior to the real-time testing.
- Conduct in-service field testing with before-and-after data collection.
- Prepare a Final Report and Research Note on the project, with methods, findings, conclusions, and recommendations.
- Make an executive presentation to the ADOT Research Council at conclusion of the project.

EXPECTED IMPLEMENTATION

This project will provide a sound basis for deployment of this technology into the Phoenix and Tucson freeway management systems in the future.

STATUS OF RESEARCH

The project will be initiated in the third quarter of 1998.

AMENDMENT(S)

None.

TECHNICAL ADVISORY COMMITTEE

Jim Decker	City of Tempe
Tom Parlante	ADOT Traffic Engineering
Dan Powell	AzTech – MDI
Jim Shea	ADOT Phoenix TOC
Glenn Jonas	ADOT Phoenix TOC
Roy Turner	Maricopa Association of Governments
Pierre Pretorius	Maricopa County
Alan Hansen, Tom Fowler	FHWA
Tim Wolfe, Manny Agah, Steve Owen	ADOT TTG

ARIZONA DEPARTMENT OF TRANSPORTATION
Joint Project Administration

Progress		Final	Payment Report
Report No. : FA : Non FA		Exp. Budget Obj. Code	Contract No. JPA 98-55
TRACS No. Project No.		Date Ending	
Name of Project:			
Name Of Consultant:			
Date Started	Estimated Completion Date:	% Billed	% Complete

SUMMARY OF WORK FOR WHICH PAYMENT IS REQUESTED

Item	Description	Total Contract Amount	Previous Accumulative Amount	Current Month	Accumulative Amount

Submitted By: _____ Date _____
Consultant

Approved By: _____ Date _____
ADOT Project Monitor

Approved By: _____ Date _____
Joint Project Administration

Total To Date	
Total Previous Report	
Current Report	

CONMASTR/PRFORMAT